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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PR 3648 for a patent by RMG SERVICES PTY. LTD. filed on 13 March 2001.

I further certify that pursuant to the provisions of Section 38(1) of the Patents Act 1990 a complete specification was filed on 08 November 2001 and it is an associated application to Provisional Application No. PR 3648 and has been allocated No. 89254/01.

WITNESS my hand this
Fifteenth day of November 2001

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
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AUSTRALIA
Patents Act 1990

P/00/009
Regulation 3.2

Revised 2.98

Provisional Specification

In. .ion Title

IMPROVED COMPOSITE ELECTRODES FOR ELECTROLYTIC AND FUEL CELLS

The invention is described in the following statement

BACKGOUND: Our company has been granted Australian Patents 654774 and 707701 and US Patents 5,569,370 and 5,882,502 concerning a new concept electrolytic cell which does not use a diaphragm to function. Our company has also been granted Australian patent no. 714126 for a new concept fuel cell which operates without the use of a diaphragm or electrolytic membrane.

Figure 1A shows the placement of the anode and cathode electrodes with the solution electrodes as applied to the electrochemical cell and the fuel cell of the patents described above. Figure 1B is another arrangement of the anode, cathode and solution electrodes of the electrochemical cell and the fuel cell covered by the subject patents.

This patent application offers another means of achieving the functions of the above electrolytic cell and fuel cell without the use of a diaphragm or electrolytic membrane or proton electrolytic membrane between the anode electrode and the cathode electrode of the electrochemical cell or the fuel cell.

1. USE OF ELECTROLYTIC MEMBRANE- Figures 2A and 2B show the construction of the composite electrodes of this application. The sides and bottom of the sandwiched elements can be completely covered by a non-conducting material so that only the anode or cathode electrode surface are in contact with the electrolyte. The solution electrode is sandwiched between two (2) proton electrolytic membranes which are in turn sandwiched by the anode electrodes or the cathode electrodes. The electrodes are immersed in the anode electrolyte or cathode electrolyte as shown on Figure 3A for the electrochemical cell.

In the electrochemical cell, the electrons are delivered to the cathode solutions at the surface of the cathode electrodes. The current travels through the cathode solution electrode and travel to the anode solution electrode. The electrons then travel through the anode electrode back to the DC power source.

For a fuel cell, the composite electrodes are located as shown on Figure 3B. Hydrogen fuel is catalysed at the surface of the anode electrode. The electrons travel to the Electrical Load and then to the cathode electrode where the electrons participate in the reaction with the oxygen at the surface of the cathode electrode. The electrons travel to the cathode solution electrode and then to the anode solution electrode then to the anode electrode to complete the electronic circuit.

2. SOLUTION COMPOSITE ELECTRODES- The electrolytic membrane described above is replaced by a conducting solution or gel as shown on Figure 4. The anode or cathode

Fig. 1A: Electrode Placement for Electrochemical and Fuel Cell

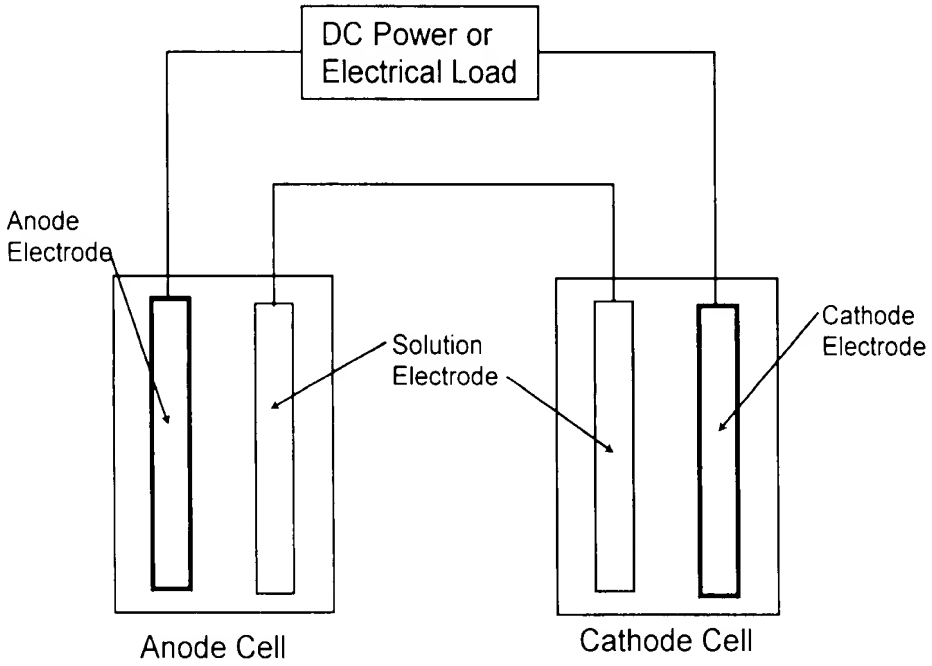


Fig. 1B: Other Electrode Placement for Electrochemical and Fuel Cell

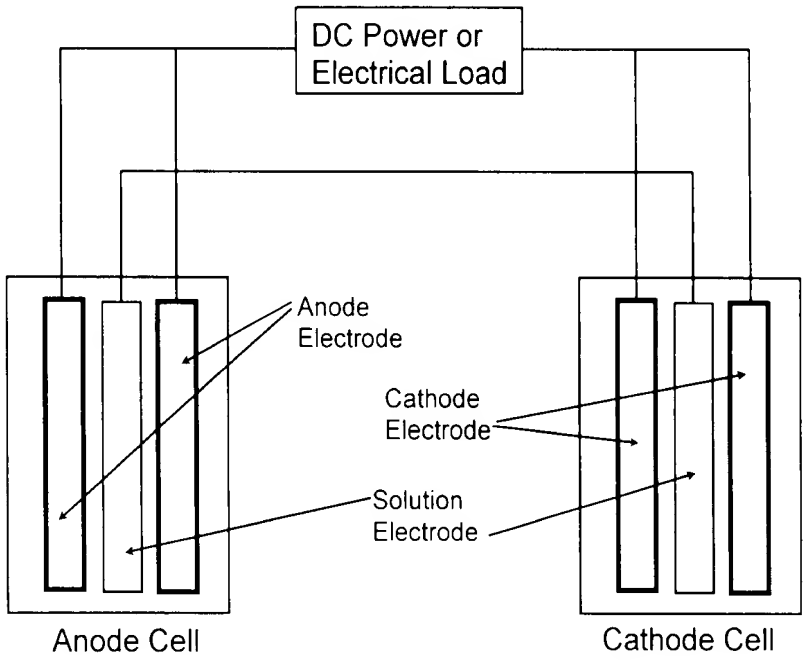


Fig. 2A: Anode Composite Electrode

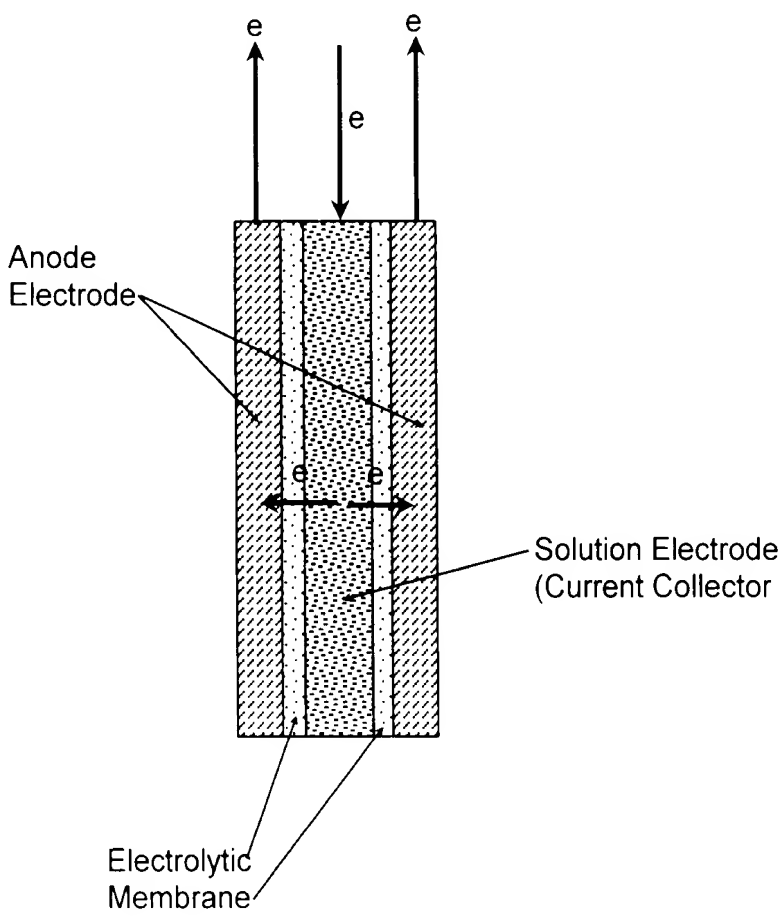


Fig. 2B: Cathode Composite Electrode

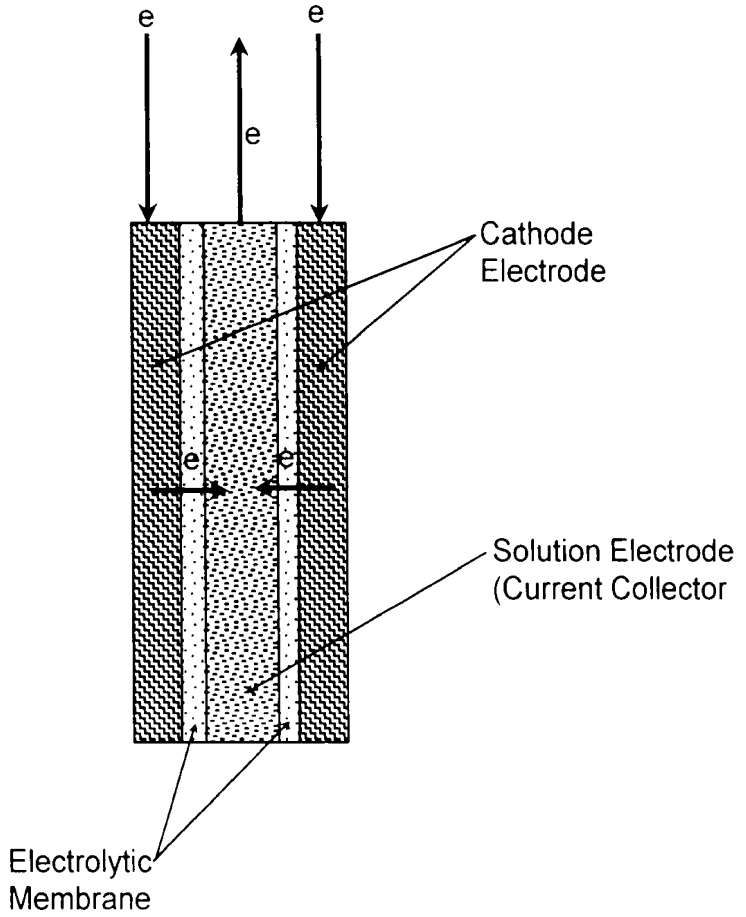


Fig. 3A: Composite Electrode in an Electrochemical Cell

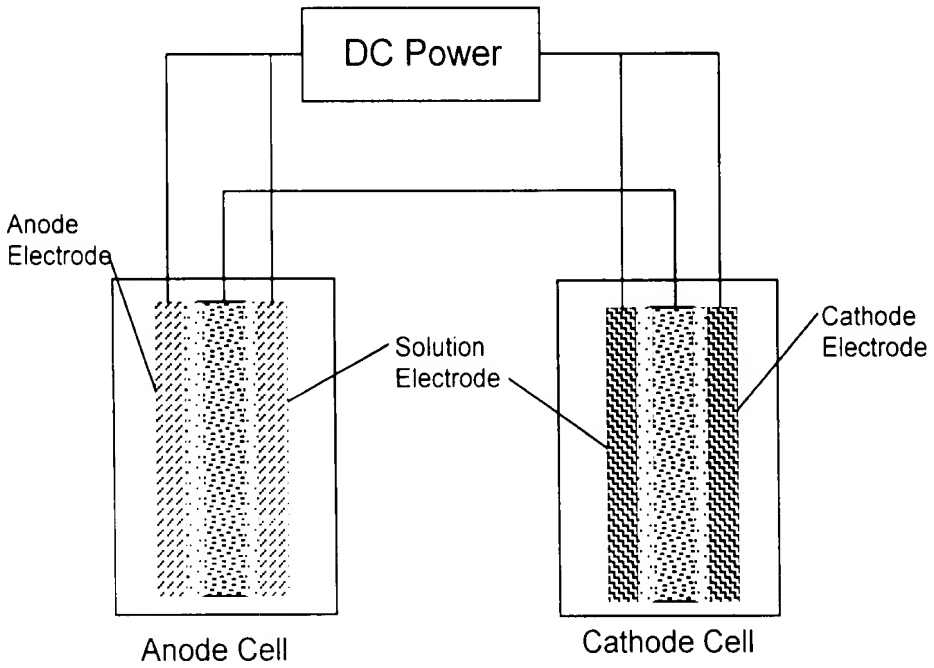


Fig. 3B: Composite Electrode in a Fuel Cell

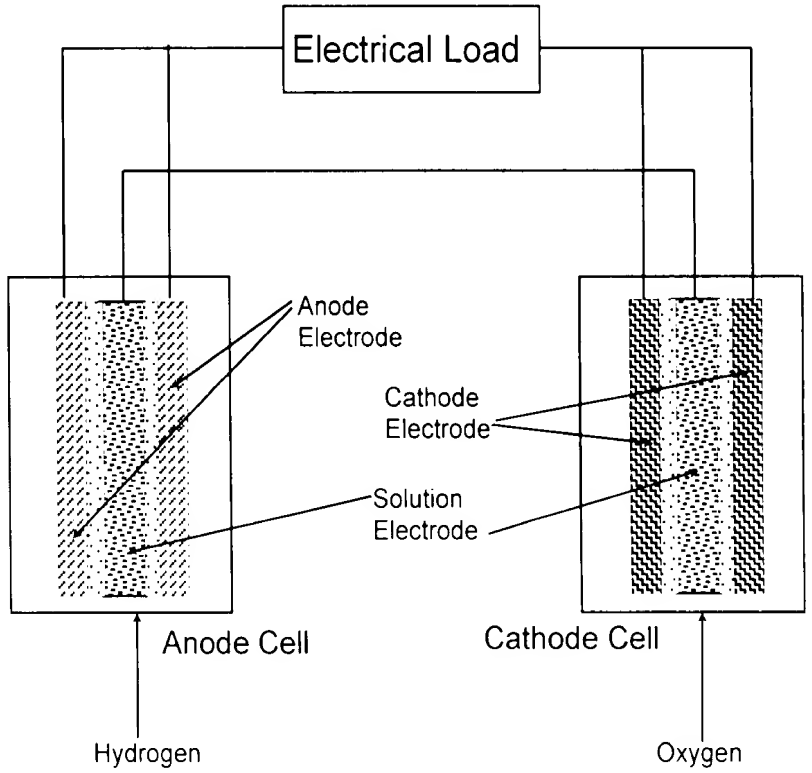
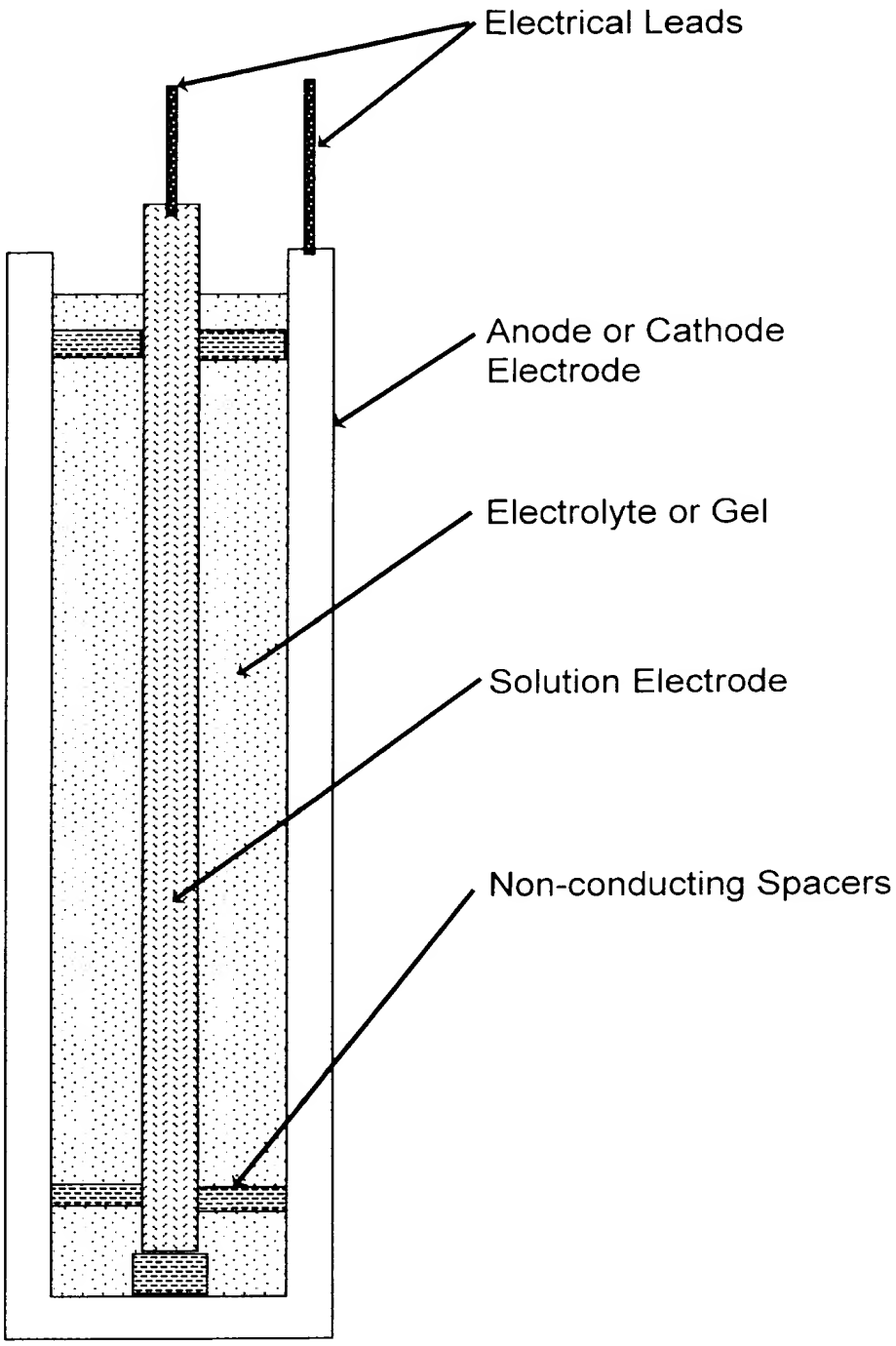


Figure 4: Composite Electrode with Solution or Gel



The invention is described in the following statement

3. electrode is of a hollow construction and the solution electrode is placed inside this hollow with electrolyte or gel filling the space between the solution electrode and the anode or cathode surface. The connections of the electrodes are the same as in Figures 3A and 3B. The electrolyte inside the anode or cathode electrode may be the same or may be different from the process electrolyte outside the anode or cathode electrode.

4. IMPROVING THE DESIRED PERFORMANCE OF THE ELECTROLYTIC CELL OR FUEL CELL- The performance of the electrochemical cell and the fuel cell as shown on Figures 1A and 1B may be improved by:

   4.1 Using a material on the surface of an electrode to favour or retard a certain reaction. For instance, in water electrolysis where the objective is to produce hydrogen peroxide, the anode electrode is made of a carbon surface since oxygen has a high over-voltage on carbon surfaces. Hydrogen has a high over-voltage on zinc but a low over-voltage on platinum.

   4.2 Installing a non-conductive mesh type structure over the surfaces of the solution electrode to prevent contact of solid reactants in the electrolyte or to increase the voltage drop at the surface of the solution electrode by reducing reacting ions. This construction will minimise possible reactions on the surface of the solution electrode so that the solution electrode only acts as a conductor of electrons to the electrolyte.

   4.3 Placement of solution electrode in relation to anode or cathode electrode- Experiments have shown that current between the solution electrode and the anode or cathode electrode travel in straight lines. Normally, the solution electrode and the anode or cathode electrodes are placed face to face with each other. In certain electrolytic process where a desired reaction is to be favoured, the electrodes are oriented perpendicular to each other. For instance, in the electrolysis of iron in an acid electrolyte, only hydrogen is evolved at the cathode if the electrodes are face to face. However, by placing the cathode perpendicular to the solution electrode, metallic iron is deposited at the cathode.

   4.4 Higher current density is used either at the solution electrode or the anode or cathode electrode to favour certain results. This is attained by blanking off some of the surface of the electrode with a non-conductor material. High current densities at the cathode are also used to produce metallic powder in extracting metals from solutions.

5. The voltage and current impressed on the electrochemical cell may be steady or pulsed or a combination of both.

The composite electrode can offer better performance in some applications of the electrochemical cell and the fuel cell than the open type embodiment of the solution electrode.

RMG SERVICES PTY. LTD. 13/03/01

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